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## Paper Session II-A - International Partnership in the Space Station Program

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## ***International Partnership In the Space Station Program***

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### **Introduction**

An Earth orbiting space station, crewed by peoples of many nations, has long been imaged even before space flight began. Today's partnership to build the international space station will register in history as the stepping stone into a new era of world space cooperation enabling humanity's future exploration of space. Pioneered by nations of Europe, Japan, Canada, and the United States, the International Space Station Program now welcomes partnership with Russia and the addition of their extensive experience in prolonged space flight. New concepts for building and operating the international space station have been created significantly broadening the roles, possibilities, and overall robustness of the space programs involved. As we enter the twenty-first century, the international space station provides a catalyst for change and growth in cooperative space exploration. Though not without its challenges, the benefits of this new partnership are far reaching. Some of these are described in this paper.

### **Background**

Shortly after taking office President Clinton directed NASA to evaluate the Freedom Space Station design and present recommendations within 90 days that provided for a faster, more robust and more reliable Station. This Herculean effort culminated in three redesign options which were presented to the President for consideration. The first, Option A, used elements of the Freedom program but considerably altered the assembly and configuration of the Station. The second, Option B, was essentially an improved Freedom design with an assembly sequence largely unaltered. The final redesign, Option C, was a radically modified Shuttle structure which would have lofted a cylindrical design substantially in one launch with outfitting and support to follow with additional Shuttle flights. The design options were evaluated independently by a committee headed by Dr. Vest of the Massachusetts Institute of Technology. He was further chartered with evaluating the management practices employed by NASA in managing the Space Station Program. After careful consideration, he recommended that design Option A best met the requirements for the Space Station. Further, his committee recommended that NASA consolidate the Space Station management to a single host center, contract for a single Prime, and employ an integrated product team approach for the management of the development of the Space Station.

After careful consideration, the President selected Option A and authorized NASA to implement this new concept for the International Space Station. This Space Station concept preserved the interests of our existing international partners and provided the flexibility for introducing new partners in space.

### **Background continued...**

The NASA Administrator directed a small team, thirty to forty personnel, to develop an implementation plan which not only brought the design option A to maturity but implemented a new management structure. That structure called for centralized budget control with clear lines of authority, relocation of the Program office to the Johnson Space Center, transition to Boeing as the single Prime contractor, and incorporation of integrated product teams for Station development. Simultaneously, the President authorized NASA to initiate a study to determine the feasibility of adding Russia as a new international partner to the Program. These efforts were done in parallel and eventually merged in November of 1994.

This activity tested the mettle of the team charged with its undertaking and certainly tested the patience of our existing Partners during the upheaval. Because of the complexity and timeline pressures keeping the Partners thoroughly informed was not always possible. However, a review of their recommendations to streamline management practices with regard to NASA's role as overall integrator were addressed and incorporated into the new international program.

What emerged from this activity was a new concept of international cooperation in space, one that will combine the best features of all participants to provide and build a capable, reliable Space Station.

### **Benefits of International Partnership**

#### **Shared Costs**

Without exception national space programs face tough budgetary challenges in every part of the world. Alone, no one nation can really afford to build and operate a space station without sacrificing other areas of space exploration. The new concept for space station maximizes on the various expertise within the partnership while recognizing the requirement each nation has to deliver their share on time and at cost. The space station now takes into consideration the benefits of using multiple space transportation vehicles, increasing reliability and simultaneously broadening opportunities for all partners.

#### **Multiple Access to Space**

One criticism of the Freedom Space Station program was its dependence on a single-launch vehicle, the NASA Shuttle. Though reliable, and enormously capable, the Shuttle remained the linchpin to the assembly and operation of the Space Station. Under certain scenarios, a significant delay in a Shuttle launch would have put the Space Station Freedom in jeopardy. For instance, a delay in re supply for the propulsion for maintaining the Space Station in orbit, might have required action to park the Station in a higher orbit while NASA sought technical solutions. Combining the capabilities of additional partners adds enormous flexibility to the continuous operation and use of the Space Station.

## Russian Partnership

The Russian Space Agency (RSA) is only three years old yet has been charged with the tremendous management responsibility of harnessing the extensive space capabilities of the former Soviet Union. Originally formed with only four major space institutes and facilities, RSA today has funding control over 42 significant enterprises ranging from research to industrial capability. RSA has also been successful in forming relations with the remaining space enterprises that were recently privatized. Also this year, Russia successfully negotiated with Kazakhstan the operations and maintenance of the Baikonur Cosmodrome from which the Russian human space program is launched.

Activities for a cooperative space program between NASA and RSA, which were to include the enhancement of Mir, joint space flights and the design, development, utilization and operations of the International Space Station were initiated in a series of agreements: June 1992 *U.S. - Russian Civil Space Agreement*; October 1992, *Implementing Agreement on Human Space Flight Cooperation*; The September 1993, *Joint Statement on Cooperation in Space* issued by Vice President Gore and Russian Prime Minister Chernomyrdin; The November 1993, *Addendum to Implementation Plan on Alpha Station*; and the December 1993, *Protocol to the Implementing Agreement on Human Space Flight*. In June 1994, RSA and NASA signed a \$400 million contract for supplies and services relating to Mir-1 and the International Space Station: Phase One and selected Phase Two activities.

The redesigned Space Station takes advantage of Russia's proven multiple accesses to space. Produced in the mid 1960s and with more than 210 successful launches to date (over 20 per year average), the Proton rocket is the workhorse launcher for the Russian space launch fleet and will launch the first element for space station assembly in 1997 and the largest Russian element service module in 1998. The Russian Soyuz launch vehicle has successfully delivered Cosmonauts to the Mir orbiting space station for fifteen years and will be used to deliver the first cosmonaut crew to the International space station in May 1998. The first U. S. astronaut to travel by Soyuz will be Norm Thaggard in March 1995 for the Mir 18 mission. The Soyuz will also provide Station with some Assured Crew Return Capability.

The propulsion job of the Station is largely allocated to the Russian Space Agency. This proven system allows an acceleration of the assembly of the Space Station with relatively little risk and enormous cost savings. The Russian Progress vehicle now used to re supply and re fuel the Mir space station will also be used for re supply and re boost capability for the International Space Station.

The Russian capabilities allow us to permanently man the Space Station at a much earlier date which greatly reduces the complexity and scheduling of extra-vehicle activity as the Space Station is built. Extra-vehicular activities (EVAs) do not need to be tied to a single, ten or fourteen day Shuttle mission but can be choreographed over a prolonged exposure.

## **Extensive Experience in Prolonged Space Flight**

The former Soviet Union has been flying space stations since the early 1970s. The basic block of the current Mir space station has been in orbit since 1986. In January 1995, a new space flight duration record was set by Cosmonaut Dr. Valeri Polyakov for 368 days. The human hours spent in space by the former Soviet Union, now Russia, far exceeds the experience of any other nation. This knowledge base is proving invaluable as the new International Space Station design gains maturity. Already extensive life science projects have been initiated to share and further data associated with human space flight. For the Phase One joint Mir and Shuttle flights our astronauts and cosmonauts are training and flying together gaining invaluable insights into the very different yet successful methods employed by the our respective programs. The Euro-Mir space flights are yielding similar benefits.

## **Broadened Opportunities for Our Partners**

The new International Space Station has broad implications, not only to NASA but to all our International Partners. No longer is NASA the sole operator and maintainer of the Station. The redesigned Space Station not only brings the space faring resources of Russia but broadens the opportunities for our other Partners to contribute to the operation of the Station.

In March of 1994, a Space Station Control Board action baselined an Automatic Transfer Vehicle (ATV) launched from an Ariane 5 that will be developed by the European Space Agency. This vehicle will be capable of delivering propellant to the Station and will provide for re boost to higher orbit. The ATV will add a redundancy to Space Station since it provides another launch vehicle for incorporation into the Traffic Model. Other scenarios of logistic re supply are under consideration. The use of this vehicle will also provide an offset capability for the European Space Agency to meet its obligations in operating the Station.

The Europeans are also exploring designs of a Crew Return Vehicle that potentially will meet Station requirements at assembly-complete to provide a rescue capability for Station astronauts in the event of an emergency. This vehicle could potentially serve as the foundation for European crew transfer vehicle that could be folded into the operations of the Station.

The Japanese Space Agency (NASDA) is now reviewing options to expand the capability of their successful H-2 program that will enable it to provide lift capability to the 51.6 degree inclination of the Station. They are exploring the possibilities of expanding a program to provide a transfer vehicle for the H-2 that can potentially play a role in the logistics re supply of the Station.

Another significant aspect of the redesign work was going to the concept of distributed operations for the Station. Not only will Russia play a major role with the Moscow command center, but ESA and NASDA are developing payload processing centers in their respective countries that reduces NASA's workload by providing for the processing of their experiments prior to shipment to Kennedy Space Center.

Canada is developing a control center that will allow them the ability to operate the Mobile Servicing System in Montreal.

For the United States, this new international partnership in space is forcing us to look beyond the immediate horizon of our own space program to the future space jobs, products, skills and services that will be needed to support humanity's trek into space. With Station, we are finally able to test and use technology that we've developed for several decades. Without Station space programs all over the world could come to a grinding halt. Promoting the enhancement and robustness of our space partners through the International Space Station will only benefit our own space program by keeping us on the edge of invention. Our greatest accomplishments in history are achieved when we look ahead into the future, when we dream of what is possible, and when we dare to build it.

### **Challenges Ahead**

These new concepts significantly broaden the roles of our existing Partners and are creating excitement within the international community on other possibilities of participation in the Space Station. All of this only ensures a more robust and healthy worldwide manned space program as we enter the twenty-first century. The Space Station is this catalyst. We are not only learning to share the opportunities and benefits of space exploration but the costs and responsibilities, as well.

The enthusiasm for the Space Station should not overshadow the challenges that face all the participants. Certainly the technical issues are within the reach and capabilities of the international aerospace community. There are many cultural differences, many ways of doing business, and differing philosophies on approaches to solving problems as well as resolving the cost sharing implications of operating and maintaining the Station. There is a large cadre of dedicated individuals working continuously all over the globe to come to an understanding on all the issues that face the Station. All of the problems identified are solvable because they will be attacked and overcome by people with the resolve to succeed.

The recent, tremendously successful rendezvous by the STS-63 crew to the Russian MIR space station underscores our ability to resolve differences and technical problems in real-time. Not since the first Shuttle was launched has a subsequent launch drawn so much excitement and expectation. We believe that our leaders in Congress and in Parliaments worldwide will continue to support our efforts as no one wants to be left in the stands as this parade goes by. All our potential differences and areas of contention pale in the sight of what we are able to accomplish.